

TERTIARY DEPOSITIONAL SYSTEMS IN UPPER COOK INLET, ALASKA: INFLUENCE OF FLUVIAL STYLE ON RESERVOIR GEOMETRIES AND STRATIGRAPHIC TRAP POTENTIAL

LePain, David L.¹; Wartes, Marwan, A.¹; Stanley, Richard G.²; McCarthy, Paul J.³;
Silliphant, Laura J.⁴; Helmold, Kenneth, P.⁴; Shellenbaum, Diane P.⁴; Peterson, Shaun⁴;
Mongrain, Jacob R.³; Gillis, Robert, J.¹; and Decker, Paul L.⁴

¹Alaska Division of Geological & Geophysical Surveys, 3354 College Road, Fairbanks, AK 99709; ²U.S. Geological Survey, 345 Middlefield Road, MS 969, Menlo Park, CA 94025; ³Department of Geology and Geophysics, University of Alaska Fairbanks, Fairbanks, AK 99708; ⁴Alaska Division of Oil and Gas, 550 W. 7th Ave., Suite 800, Anchorage, AK 99501

Cook Inlet is part of a large collisional forearc basin with significant petroleum resources. Commercial hydrocarbon production in the basin has been limited to complex Tertiary fluvial reservoirs in structural traps. Recent work in the basin has focused on reconstructing depositional systems in Tertiary strata to improve understanding of stratigraphic trap potential.

Along the mildly deformed eastern basin margin, in the vicinity of Kachemak Bay, gravelly braided fluvial systems occupy incised valleys eroded into deformed pre-Tertiary strata of an accretionary complex. Paleovalley-fills grade up-section and basinward (west) to aeri ally extensive nonmarine systems that include a variety of fluvial channel styles, each flanked by floodbasin settings. Sand-rich systems deposited tabular sand bodies separated by thin (<10 m thick) coal-bearing mudstone successions. Amalgamated sand bodies typify these systems with composite thicknesses commonly >15 m. Mixed-load systems deposited tabular sand bodies up to 12 m thick with prominent fining-upward trends, but separated by up to 20 m-thick coal-bearing mudstone successions that encase small channelized sand bodies 4-10s of meters wide and 1-5 m thick. Along the deformed western basin margin, in the vicinity of Capps Glacier and the Beluga River, depositional systems include large alluvial fans and a similar variety of lower-gradient alluvial systems away from the margin as recognized in the vicinity of Kachemak Bay.

Depositional systems along both basin margins are characterized by higher gradients, coarser and less mature sediment textures, and little preserved finer-grained material capable of forming reservoir seals. Away from the basin margins, fluvial gradients were lower resulting in a wider range of sediment textures, sand body geometries, and mudstone successions capable of serving as effective reservoir seals.